How to Reduce Pollutant Loads and Improve Water Quality in Kawa Stream (Kane`ohe, O`ahu)

A Total Maximum Daily Load Implementation Plan for watershed health

State of Hawaii Department of Health, Environmental Planning Office
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Table of Contents

Kawa Stream Total Maximum Daily Load Process

Kawa is a relatively short stream (~ 2.5 miles or 4.1 km long) that flows year-round into southern Kaneohe Bay, O`ahu. The stream drains an urbanized area (~ 988 acres or 4.0 $km^2$) that includes two cemeteries, residential and commercial developments, schools and parks, a golf course, and a municipal sewer pumping station. The eastern edge of this watershed is defined by the ridge of hills separating Kane`ohe from Kailua, and the shoreline runs from Kokokahi and BayView GolfPark on the east to Waikalua (an early Hawaiian fishpond) on the west (Figure 2).

After an inspection in 1996 (Appendix I), Kawa Stream was placed on the 1998 State of Hawaii under Clean Water Act §303(d) list of impaired waters. High levels of nutrients, turbidity, and suspended solids were listed as the causes of poor water quality. The complete statewide list of impaired waters and supporting information can be viewed online at http://www.epa.gov/region09/water/tmdl or can be requested from the State of Hawaii Department of Health (contact information given on the cover page of this document).

The Clean Water Act requires that the State of Hawaii conduct a pollutant-specific water quality planning process for these impaired waters. With funding provided by the U.S. Environmental Protection Agency (EPA), the State of Hawaii Department of Health (DOH), Oceanit Laboratories, Inc., and AECOS, Inc. conducted a technical study of water pollution in Kawa Stream. We calculated existing pollutant loads, determined relationships between these loads and State water quality standards, and suggested how pollutants, source areas, and stream environments could be managed to achieve necessary water quality improvements.

Total Maximum Daily Loads (TMDLs), which establish the maximum rate at which Kawa Stream can receive certain pollutants (in this case, nutrients or sediments) without exceeding the State's water quality standards, were submitted to EPA in March 2002. EPA approved these TMDLs in June 2002 and the final Kawa Stream TMDL report (Oceanit Laboratories, Inc., et al. 2002) is viewable online at http://www.state.hi.us/doh/eh/epo. The report is also being distributed to public libraries on O`ahu (including Kaneohe, Castle High School, and Windward Community College) and can be requested from the State of Hawaii Department of Health.

The TMDL report concluded that excess nitrogen is the most common pollutant problem in the watershed. Excessive phosphorous and sediment loading occurred only during storm events, but low rainfall during the 2000-2001 study period suggests that long-term, storm-related pollution may be greater than the short-term loads we calculated. The report and its affiliated Stream Bioassessment (Burr 2001, also viewable online at http://www.state.hi.us/doh/eh/epo) also indicate that the stream, in general, does not provide good habitat for native aquatic organisms and does not support any substantial populations of native fish and crustaceans (see Appendix II, Kawa Stream TMDL Executive Summary).

This TMDL Implementation Plan identifies specific activities that can help reduce pollutant loads, improve water quality, and increase Kawa Stream's ability to support native Hawaiian aquatic biota. Such activities may be prioritized for funding from DOH (Clean Water Act Section 319(h) grants) and the Kailua Bay Advisory Council. The plan also introduces an alternative water quality management practice, Use Attainability Analysis, that can be used to modify existing protection for particular uses of Kawa stream and subject the stream to a different set of water quality standards than those now in effect.

Implementation Plan Summary

This TMDL Implementation Plan suggests a framework for community action to reduce pollutant loads and improve water quality in Kawa Stream. It is not a plan for comprehensive stream restoration or watershed restoration, although the actions suggested can achieve restoration objectives and be part of an ongoing process that may take several lifetimes to complete. While effective restoration requires widespread participation (lots of people) and implementation (lots of places), significant pollutant load reductions and water quality improvements can start immediately by working with smaller groups on specific problem areas.

The results of a brainstorming exercise conducted during TMDL development (October 2001) were used to begin the TMDL implementation planning process (see Appendix III). Strategies and tactics that may help reduce pollutant loads and/or improve the stream's ability to assimilate them were developed with input from various key participants in watershed affairs (these and other key participants are listed in Appendix IV). Considering that land use in the watershed is developed to nearly the maximum extent allowed by current zoning, we emphasize pollution prevention in existing households and commercial and public facilities; environmental maintenance, especially erosion control, within and along stream channels; stormwater management in urban drainage systems; and watershed education and stewardship.

Five major strategies are proposed to guide the funding and application of these solutions:

1. **Increase community interest and capacity in protecting and enhancing stream ecosystems**
   Key Participants: Schools, Non-Government Organizations (NGOs), Elected officials

2. **Reduce nutrients and sediments in watershed runoff**
   Key Participants: Residents, Businesses, Public facilities, Urban drainage system operators (State and County agencies), Other agencies (Regulatory, Technical and Financial assistance)

3. **Establish vegetated buffers adjacent to stream.**
   Key Participants: Riparian landowners, NGOs, Other agencies (Technical and Financial assistance)

4. **Improve the stream's ability to move water, filter pollutants, and support aquatic life.**
   Key Participants: Channel owners and operators (private and public), NGOs, Other agencies (Regulatory, Technical and Financial assistance)

5. **Stabilize the stream channel in ways that maintain its ability to filter pollutants and support aquatic life.**
   Key Participants: Channel owners and operators (private and public), Other agencies (Regulatory, Technical and Financial assistance), State Legislature

This plan provides a generalized list of management and control measures that can be used to execute these strategies and identifies particular areas that could benefit from these measures. Specific projects are discussed that may provide support for overall strategy development; pinpoint key locations for management activity; create facility management plans; and install, operate, and maintain site-specific control measures.

Funding from numerous sources is available to assist with these projects. As projects are completed, they may generate more awareness and technical knowledge of water quality management tools. This can lead to more widespread use of various control and improvement measures and to better understanding of project cost and effectiveness.

1.0 WATER QUALITY PROBLEMS

Basic Processes

Water quality problems in Kawa Stream result from the combined effects of low baseflow, surrounding land use and human activity, stream channel alterations, and occasional storm events and flooding. Baseflow is the long-term, dependable amount of water in the stream. This flow is dependable and continual because it comes from groundwater sources that store large volumes of rainwater over long periods of time. As the groundwater moves through its storage compartments, it is slowly released by springs and seeps throughout the watershed. Kawa's base flow, typically defined as the rate that is exceeded 90% of the time (the flow is less than this only 10% of the time), is about 200,000 gallons per day. This is the amount of water that is usually available to receive all of the pollutant loads reaching the stream. Sources of nutrients in groundwater feeding Kawa stream baseflow may include natural background from soils and rainfall; sewer and cesspool failure; and fertilizers, animal wastes, and household and commercial products that drain into the ground. Baseflow may also carry nutrients and sediments that were dumped directly into the stream.

The average flow of Kawa Stream is about 1 million gallons per day. This is much greater than the baseflow because it includes contributions from two additional water sources – short-term rainfall and everyday human water use (such as washing cars in driveways or parking lots). Both of these sources produce "watershed runoff" that brings the effects of surrounding land use and human activity (pollutants) to the stream. As the amount of runoff and/or pollutants reaching the stream increases, water quality can improve (more flow) or deteriorate (more pollutants). Assuming no change in baseflow, this additional "watershed runoff" and average streamflow have probably been increasing over the last 50 years because infiltration capacity has been shrinking while the amount of impervious cover and human water use has been growing.

Most of this runoff is collected by storm drains that deliver it directly to the stream with little, if any, treatment of the pollutants it carries. Sources of the nutrients and sediments carried in Kawa watershed runoff include natural background from soils and rainfall; erosion-prone hillslopes and stream banks; and fertilizers, animal wastes, and household and commercial products and grime that were washed, spilled or applied onto or near the ground surface. As with watershed runoff and average streamflow, the amount of pollutants available for transport to the stream has probably been increasing over the last 50 years because absorption capacity has been shrinking while the use of pollutants has been growing.

As a result of urban development (such as road construction and flood protection projects), extensive sections of the Kawa stream channel have been moved, lined with concrete, and otherwise altered from their natural state. Channel alterations and surrounding development have reduced or eliminated natural floodplain, bank, and bed areas that hold back and absorb the pollutants carried in streamflow. Alteration also changes the size, shape, and roughness of

channels in ways that may cause changes in streamflow velocity and direction, water level, temperature, oxygen content, and acidity/alkalinity (pH).

Higher streamflow velocity can increase the ability of the stream to erode its bed and banks and to carry eroded material, resulting in larger sediment and nutrient loads and less deposition of desirable rocks and pebbles in the stream bed. It can also hinder the upstream migration of native aquatic organisms. Lower water level means faster and higher increases in water temperature, better habitat and faster growth for some terrestrial and aquatic weeds, and less underwater fish habitat area, all of which can be harmful to native aquatic animals. Temperature also influences the rate of chemical reactions occurring in the stream - such as nutrient uptake by plants and changes in pH - and temperature increases can contribute to algal blooms that clog the channel and lower stream oxygen content. Changes in both oxygen content and pH can also be harmful to native aquatic animals.

Channel alterations also change the composition of the stream bed and banks in ways that may further increase pollutant loads and degrade water quality and aquatic habitat. In Kawa Stream, many of the old channel alterations are past the end of their design life and are crumbling into the stream. In some of these areas, new alterations are proposed to make the channel conform with City & County of Honolulu drainage standards and to protect adjacent private property from erosion. These new alterations typically result in bigger channels (to handle higher flows) with concrete linings. Concrete linings don't support plants that shade and feed the stream (and less plants means less insects, which also feed the stream) and concrete stream beds don't provide the rocky, gravelly substrate habitat preferred by native stream organisms.

Occasional storm events may deliver the equivalent of years, even decades, of the pollutant loads received over time under less extreme weather conditions. In addition to moving larger amounts of water and pollutants through the watershed at faster than normal rates (particularly sediments, in surface runoff and scoured from the channel by raging streamflows), storms and floods change the size, shape, and composition of the channel. This can generate both physical and social effects that lead to future water quality problems, such as loss of streamside vegetation and public demand for protection from future flood events.

Problem Areas (see Figures 1 and 2, pages 6 and. 7)

The TMDL report identified areas in the stream where excess nutrients (nitrogen and phosphorous) and suspended sediments were concentrated during the field study period (see report, pages 28-34 and Tables 5.4, 5.5, and 5.6). While all of these areas are considered high priority for pollutant load reduction and water quality improvement, the single largest problem for TMDL implementation appears to be excess nitrogen loads throughout the watershed (see report, pages 60-61). The largest source areas for these loads seem to be cemetery lands and residential areas (combined, about 68% of the total loads), with about 1/3 of the total loads contributed by Basins 1 (largest cemetery load) and 3 (largest residential load) [see Table 5.5 below]. Drainage from Basin 5, including Windward City Shopping Center and parts of the Castle High School Campus, appears be responsible for much of the increase in nitrate concentrations observed in the lower stream reach.

The largest source areas for phosphorous loads seem to be forest lands and residential areas (combined, about 67% of the total loads), with over 1/3 of the total loads contributed by Basins 3

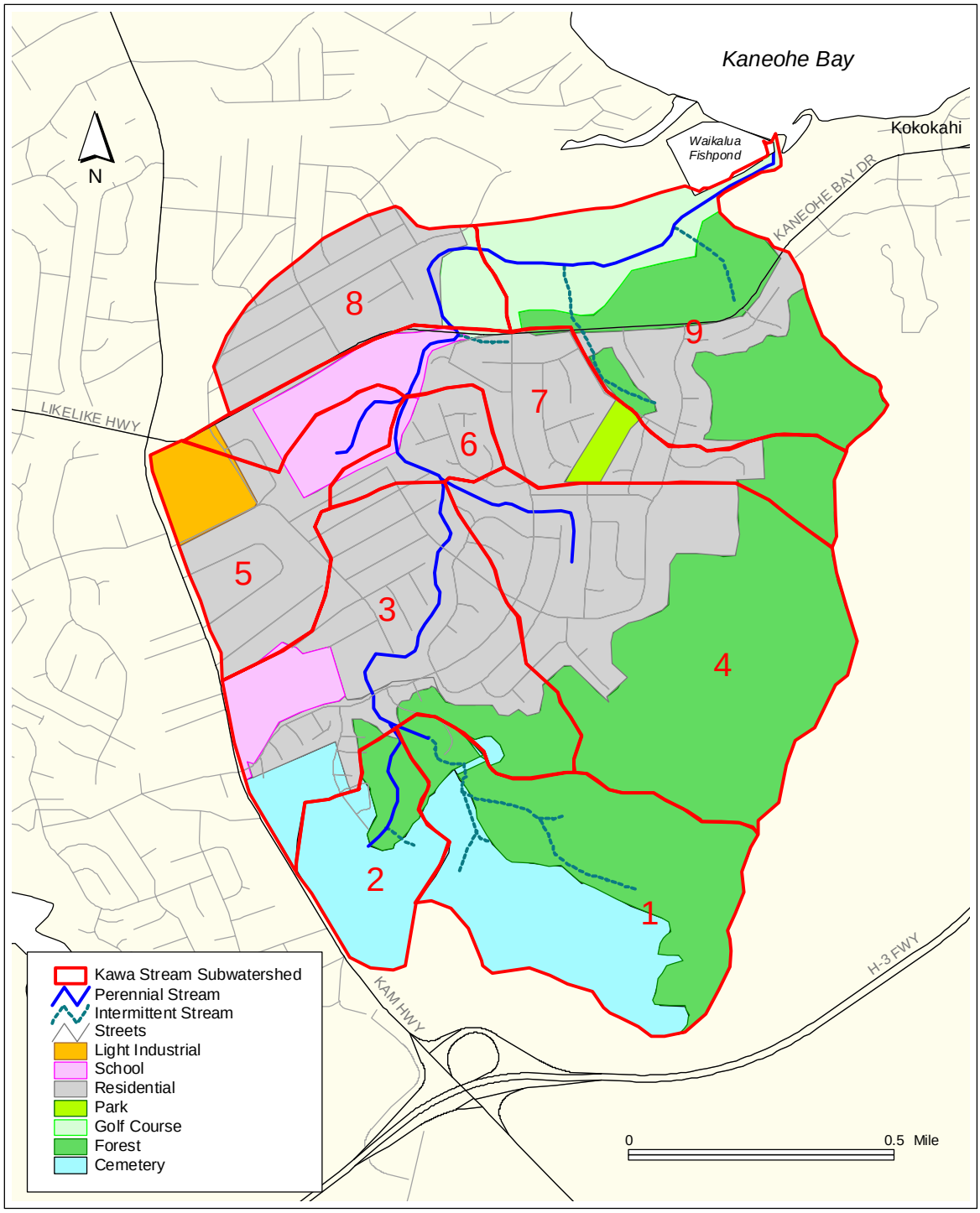
(largest residential load) and 4 (largest forest load) [see report, Table 5.6]. Drainage from Basin 2 (which consists solely of cemetery and forest areas, with possible inflow from urban storm drains) showed the highest phosphorous concentrations measured during the study.

Although our analysis suggested that, on an annual basis, no sediment load reductions are required to attain State water quality standards in the stream (see report, Table 5.4c.), such reductions are proposed under storm runoff conditions (see report, page 61) and erosion control measures are a high priority throughout the watershed. For all land uses and sub-basins, existing loads were calculated at about 91% of the loading capacity established by the TMDL (see report, Table 5.4). However, unusually low rainfall during the TMDL field study period may have produced less erosion and lighter sediment loads than would be generated under higher rainfall conditions. Reports from long-term residents indicate a history of erosion, sediment runoff, and turbid stream water during large rain events in Kaneohe, and sediment loads are a likely source of excess nutrients (particularly phosphorous) in the stream (see report, page 33).

The largest source areas for sediment loads seem to be residential areas and cemetery lands (combined, about 65% of the total loads), with about 1/3 of the total loads contributed by Basins 3 (largest residential load) and 4 (no cemetery load, largest forest load). Basins 1 (large cemetery load), 7 (large residential load), and 9 (golf, residential, and forest loads) combine to supply an additional 38% of the sediment load (see report, Table 5.4a). Loads from cemetery source areas may have less long-term significance than suggested by these figures since construction projects and temporary dirt stockpiles may have contributed to high concentrations measured during the field study period. On the other hand, the poor vegetation and slope conditions observed along the stream banks suggest that sediment loads from erosion and scour of the stream channel itself during larger storm events may have great long-term significance (e.g. see Figure 1. below).

Figure 1. Degraded stream channel – note algae in the water and steep, eroded, unvegetated bank

Figure 2. Map of Kawa Stream Watershed



Calculation of Annual Load Reduction Targets for Total Nitrogen

(Table 5.5**,** p. 56 in Oceanit Inc., et al. 2002.)

a. Existing Distribution of Total Nitrogen in the Watershed

Pollutant Load by Basin and Land Use Sector
Total Wt of Pollutant is 1378 Kg. TN

/----------Land Use Category----------\

Basin #	**Cemetery**	Forest	Golf	Commercial	Park	**Residential**	School	Streets	Grand Total
1	193	35	0	0	0	0	0	0	**228**
2	113	5	0	0	0	0	0	1	119
3	38	8	0	0	0	137	31	16	**229**
4	0	57	0	0	0	131	0	10	198
5	0	0	0	30	0	72	27	5	134
6	0	0	0	0	0	36	5	3	44
7	0	7	2	2	11	94	35	10	161
8	0	0	19	0	0	83	0	8	110
9	0	31	76	0	0	43	0	5	155
Grand Total	**343**	143	97	32	11	**596**	98	58	**1378**

b. Watershed-Distributed TMDL for Total Nitrogen

Pollutant Load by Basin and Land Use Sector
Total Wt of Pollutant is 414 Kg. TN

/----------Land Use Category----------\

Basin #	Cemetery	Forest	Golf	Commercial	Park	Residential	School	Streets	Grand Total
1	58	11	0	0	0	0	0	0	69
2	34	1	0	0	0	0	0	0	36
3	11	3	0	0	0	41	9	5	69
4	0	17	0	0	0	39	0	3	59
5	0	0	0	9	0	22	8	2	40
6	0	0	0	0	0	11	1	1	13
7	0	2	1	1	3	28	11	3	48
8	0	0	6	0	0	25	0	2	33
9	0	9	23	0	0	13	0	2	46
Grand Total	103	43	29	10	3	179	30	17	**414**

c. Load Reduction Allocations for Total Nitrogen

Pollutant Load by Basin and Land Use Sector
Total Wt of Pollutant is 964 Kg. TN

/----------Land Use Category----------\

Basin #	Cemetery	Forest	Golf	Commercial	Park	Residential	School	Streets	Grand Total
1	135	25	0	0	0	0	0	0	160
2	79	3	0	0	0	0	0	1	83
3	26	6	0	0	0	96	22	11	161
4	0	40	0	0	0	92	0	7	139
5	0	0	0	21	0	50	19	4	94
6	0	0	0	0	0	25	3	2	31
7	0	5	1	2	8	66	24	7	113
8	0	0	14	0	0	58	0	6	77
9	0	22	53	0	0	30	0	4	108
Grand Total	240	100	68	23	8	417	69	41	**964**

NOTE – Due to rounding procedures used in data tabulation, Grand Totals may not match the sum of entries in each table column or row.

In addition to the problem areas discussed above, many other water quality problems have been noted or suggested during the TMDL development process. Some of these may involve or influence nutrient and sediment loading, such as leaking sewer lines; cesspools adjacent to the stream; litter; illegal dumping and waste disposal; channels choked with alien species of grasses; and high water temperatures in channel sections lined with concrete.

2.0 GENERAL PRESCRIPTION FOR WATERSHED HEALTH

The following menu of management and control measures (commonly referred to as "best management practices" or "BMPs") can guide the execution of previously outlined strategies for reducing pollutant loads and improving water quality. This reference for action planning in Kawa and other highly urbanized watersheds is based on suggestions from watershed stakeholders, supporting agencies, and the professional water quality management literature. Detailed discussion of these measures and more is located in a number of planning documents and other reference materials (see Bibliography). The discussions in two of these documents (Polluted Runoff Control Program 2001 and Hawaii Coastal Zone Management Program 1996) are particularly important because they provide a framework for evaluating applications for government funding of pollutant reduction and water quality improvement projects.

Tools for increasing community interest and capacity in protecting and enhancing stream ecosystems

- Establish and staff a Watershed Council or other community-based advisory group to lead and coordinate implementation efforts, particularly:
    - promoting pollutant load reduction and water quality improvement
    - educating stakeholders about best management practices
    - supporting local initiatives
    - participating in government decisionmaking.
- Educate government agencies and elected officials about specific water quality problems and encourage them to take action through partnerships and their existing authorities and programs.
- Expand education and outreach capacity for using existing pollution prevention information and programs to initiate action with households, businesses, and public facilities and to develop new information and programs aimed at currently underserved sectors (e.g. groundskeeping at cemeteries, golf courses, commercial centers, schools and parks)

Tools for reducing nutrients and sediments in watershed runoff

- Use best management practices for fertilizer use in agriculture, golf courses, and landscaped areas (cemeteries, lawns, parks, school grounds) including:
    - Write nutrient and irrigation management plans and document their implementation
    - Identify nutrient deficiencies by testing soil and plant tissue
    - Apply only the nutrient(s) needed to correct these deficiencies, and no more
    - Use slow-release fertilizers
    - Use green manure, compost, and animal waste as alternatives to soluble inorganic fertilizers
    - Time fertilizer and irrigation applications to avoid rainfall and runoff

    - Establish vegetated buffers or retention ponds to intercept runoff before it reaches streams

- Use best management practices for controlling erosion and sedimentation, including:
    - Identify badly eroding hillslopes and stream banks
    - Revegetate hillslopes to reduce their erodibility
    - Create sediment detention/retention basins to manage hillslope runoff
    - Create vegetated buffers along the stream to filter runoff and prevent it from reaching stream
    - Revegetate stream banks with plants that have extensive root systems to hold soil
    - Reduce herbicide use on vegetated stream banks and buffers
    - Reduce erosion in deeply incised channel sections by stabilizing stream banks with toe protection and/or bank protection (e.g. boulders, gabions, vegetative root structure)

- Use household and commercial best management practices for reducing the use of pollutants and their availability for transport to the stream:
    - Provide education and outreach to build awareness about sources of pollution, alternative products, safe disposal of wastes, and stream function and history
    - Sweep pavements (don't wash or blow) to reduce pollutant loads
    - Put more trash cans in public places
    - Enclose trash dumpsters with curbs and roofs
    - Increase site permeability and stormwater detention (for example, using permeable pavements, rain barrels, water gardens, greywater reuse)
    - Install and maintain on-site storm drain inlet protection

- Use best management practices for treating urban storm water runoff to remove sediments and nutrients before they enter receiving waters:
    - Trap sediments at storm drain inlets or catch basins
    - Clean catch basins regularly
    - Design new channel stabilization and flood control projects with pollutant removal components such as permeable bottoms, sediment retention basins, buffer strips
    - Design new developments to minimize stormwater discharge by:
        - Minimizing paved surfaces
        - Draining roofs, driveways, and other impermeable surfaces to vegetated areas and dry wells
        - Directing runoff to grassy swales to promote infiltration
        - Creating vegetated buffers along stream

- Use best management practices to reduce polluted runoff from roads and roadsides
    - Reduce erosion along roadsides by planting more groundcover and using herbicides more precisely
    - Add vegetation, swales, settling basins and catch basins along roadsides to trap and absorb runoff
    - Identify undersized culverts at road crossings and replace them with larger culverts to improve flow and reduce debris clogging

- Use best management practices for wastewater systems
    - Upgrade cesspools near the stream to septic systems or connect users to central collection systems
    - Identify abandoned and unused cesspools, pump them out, and fill/seal if possible
    - Conserve water to minimize cesspool, septic, and sewer loads
    - Disconnect stormwater drains from sewer lines
    - Cap sewer line clean-outs
    - Don't use mechanical garbage disposal – throw food waste in trash or compost to reduce wastewater loads
    - Use low phosphate detergents

Tools for establishing vegetated buffers adjacent to stream

- Recut streambanks to make them less steep, more stable
- Restore riparian vegetation to stabilize stream banks
- Stop broadcasting/spraying herbicides along streambanks and in the stream

Tools for improving the stream's ability to move water, filter pollutants, and support aquatic life

- Clear alien grasses from channel
- Remove water-consuming alien vegetation
- Plant trees along banks to provide partial shade
- Remove built-up sediments within the stream channel
- Conduct educational stream clean-ups
- Establish a "citizen's watch" to prevent illegal dumping
- Increase the quantity of water flowing in the stream through additions from groundwater sources
- Construct low flow channels, especially in sections with concrete bed
- Enhance stream habitat by reconstructing rock-dominated substrate and establishing a variety of riffles, runs, and pools along the stream
- Increase in-stream and off-stream flood storage capacity through improved maintenance, wetland rehabilitation, and new construction of detention and retention features

3.0 PRIORITIES FOR TOTAL MAXIMUM DAILY LOAD IMPLEMENTATION

Use of the tools outlined above to reduce pollutant loads and improve water quality would ideally take place as part of a comprehensive and coordinated stream and watershed management efforts, and some of the tools may be used to organize such an effort. However, pollutant loads can be reduced and water quality can initially be improved at much smaller scales, gradually leading to the recovery of stream health and setting the stage for more widespread stream and watershed management and restoration initiatives.

During the course of implementation planning, several problem areas and potential solutions were identified and discussed with watershed residents and organizations. These form the initial set of project-specific priorities for Total Maximum Daily Load Implementation:

Hawaii Veterans Cemetery: A recent assessment of cemetery repair and maintenance needs identified severe drainage and erosion problems in sections 147 and 108-95 and a need to install sidewalk coverts and hire additional groundskeepers (Office of Veterans Services 2002). These problems and needs were confirmed during a site visit and interview with the Cemetery Operations Manager and could be partially addressed using 319(h) and other funding sources.

While routine landscape maintenance practices (irrigation, fertilization, weed and pest control) appear to be low-input and low-impact, there is no written management plan or systematic record-keeping to guide and verify these operations. Writing and implementing landscape management plans and maintenance procedures is suggested as the starting point for achieving longer-term reductions in pollutant loads from this facility.

Free technical assistance for writing these kinds of plans and procedures is available to farmers and ranchers and to individual households and other residence facilities. Although program informational material is readily available (http://www.hi.nrcs.usda.gov/eqip.htm for U.S. Department of Agriculture Environmental Quality Incentives Program, http://www2.ctahr.hawaii.edu/wq/HAPPI for University of Hawaii Pollution Prevention Information), these programs do not extend their individualized services to landscape maintenance operations for non-agricultural, non-residential facilities such as cemeteries, parks, school grounds, golf courses, and commercial centers. Thus expanding the delivery of pollution prevention planning assistance to these types of facilities is a priority for reducing pollutant loads.

Hawaiian Memorial Park Cemetery: A site visit and interview with the Location Manager focused on potential pollutant loading from a wash area. While landscape management practices (irrigation, fertilization, weed and pest control) appear to be low-input and low-impact, there is no written management plan or systematic record-keeping to guide and verify these operations. Thus writing and implementing landscape management plans and procedures is suggested as a first step in reducing pollutant loads from this facility (see discussion of technical assistance for Veterans Cemetery above), along with managing use of the wash area to reduce the amount of runoff reaching the stream.

Windward City Shopping Center and Other Commercial Areas: There are several commercial areas in the watershed where the planning and implementation of BMPs for commercial operations could help reduce pollutant loads and improve water quality. A follow-up letter explaining the implementation planning process was sent to Windward City Shopping

Center at their request. We anticipate (as with the cemeteries and golf course) that site visits, detailed identification and mapping of drainage facilities, water quality education, creating a written management plan, and systematic record-keeping for commercial facilities will be key elements of TMDL implementation for these areas **(**see discussion of technical assistance for Veterans Cemetery above).

Castle High School: Based on previous site visits and discussions with the teaching staff, we identified several implementation project tasks:

- bank stabilization
- neighborhood education
- aquatic species surveys
- laboratory analysis of water column samples
- program development with Future Farmers of America and Windward Oahu Soil and Water Conservation District
- detailed analysis and remediation of pollutants in the "ag stream"
- hiring teachers for water quality education curriculum

There are at least three other schools within the watershed that have not yet directly participated in the TMDL process. Thus education and outreach efforts at Kaneohe Elementary, St. Mark Lutheran, Pouhala Elementary, and other schools in the area is also a priority for TMDL implementation.

BayView Golf Park: The golf course would like to stabilize portions of the stream bank that appear to be rapidly eroding, remove mangrove from the stream channel, and use the stream as a source of irrigation water. These projects could be partially addressed using 319(h) and other funding sources.

While routine landscape maintenance practices (irrigation, fertilization, weed and pest control) appear to be low-input and low-impact, there is no written management plan or systematic record-keeping to guide and verify these operations. Writing and implementing landscape management plans and maintenance procedures is suggested as the starting point for achieving longer-term reductions in pollutant loads from this facility (see discussion of technical assistance for Veterans Cemetery above).

An adjacent land development project is negotiating drainage easements with the golf course. The golf course and other Kaneohe residents are concerned that this project may convert portions of a wetland area to residential use. The golf course is also concerned that changes in runoff associated with the project would change the hydrology of another wetland area on the golf course property and further degrade wetland, stream, and bay water quality. We suggest that resolution of these concerns would benefit from ongoing water quality education and from community organizing around water quality issues.

Waikalua Loko Fishpond: Before the construction of the Kaneohe Sewage Treatment Plant (circa 1958), Waikalua Loko fishpond received fresh water inflow from Kawa and Kaneohe streams, trapping their nutrient and sediment loads before they entered Kaneohe Bay. While old plans for the expansion of BayView Golf Park included re-aligning Kawa Stream to restore fresh water inflow to the fishpond (Tyrone T. Kusao, Inc. 1990), this component of the expansion project was not built.

We discussed opportunities to use Kawa and Kaneohe streams as sources of fresh water and nutrients for fishpond operations, and to use the fishpond as a sink for stream nutrients and sediments, with the Board of Directors of the Waikalua Fishpond Preservation Society. These opportunities are complicated by the additional administrative, operational, and maintenance burdens (such as de-silting) they would add to the preservation work. Nonetheless, the Society favors rebuilding an `auwai to carry water from Kawa Stream into Waikalua Loko and revegetation of the stream banks by native plants (see details in Appendix VI).

The more successful we are at controlling sediment and nutrient loads upstream, the easier it will be to manage the remaining load downstream. One possibility for downstream load management would team the Preservation Society with other facilities that manage large land areas near the Kawa and Kaneohe stream mouths (BayView Golf Park, Kaneohe Sewage Treatment Plant, Kahua O Waikalua Neighborhood Park, Puohala Elementary School, and YWCA Camp Kokokahi) to investigate the potential for a broader-scale streamflow treatment scheme. This idea will be revisited when DOH plans TMDL implementation for Kaneohe Stream.

Kaneohe Sewage Management Facility and Kahua O Waikalua Neighborhood Park: Phase I of Neighborhood Park Construction (in progress) includes a parking lot and comfort station. Scheduling of subsequent phases (playing fields and park grounds) depends upon City budgeting for both park construction and for removal and upgrade of existing sewage tanks. There may be room for changes to the design of these phases that would provide space and management capability for pollutant load reduction and water quality improvement projects (see Waikalua Fishpond Section above). This area at the confluence of Kawa and Kaneohe streams has been targeted in previous studies for the installation of pollution control measures (settling basins) and restoring historic wetlands (Kaneohe Bay Master Plan Task Force 1992). We suggest that ongoing public education and community organizing around water quality issues may lead to further interest in the future use of this area for water quality improvement.

Priorities proposed by the Kailua Bay Advisory Council (KBAC): KBAC was established by a Consent Decree that mandated the City and County of Honolulu to correct discharge problems from its Kailua sewer treatment plant. KBAC's mission is to implement the part of the Consent Decree establishing three specific programs to address improving the water quality of the Koolaupoko region, defined as the windward O`ahu watershed area between Waimanalo and Kualoa (thus including Kawa Stream and Kaneohe Bay). One of these three programs (the Implementation program) funds projects that directly aid in improving water quality in Koolaupoko. In addition, KBAC has produced an interim master plan that seeks to satisfy DOH watershed planning criteria to qualify as a Watershed Restoration Action Strategy (WRAS) for the Koolaupoko region. If approved, projects identified in the Master Plan will be prioritized for federal funding consideration from the State's 319(h) program.

KBAC has produced numerous documents that assess water quality, identify pollutant sources, and discuss technical and societal problems, opportunities, and achievements in water quality management (e.g. Ashizawa and Krupp 1999; Dashiell 1998 and 2000; Kailua Bay Advisory Council 2002; Miller 1998; Taum 2001; Young 1999). Of the sixteen recommendations in KBAC's Final Technical Program Report (Comprehensive Planning Services of Hawaii 2001), four suggest priorities for Kawa Stream TMDL Implementation, as do five of the actions proposed to address "severe problems" identified in the South Kaneohe, Kailua, and Waimanalo "sub-areas" (Kailua Bay Advisory Council nd.d):

KBAC FINAL TECHNICAL PROGRAM REPORT RECOMMENDATIONS

- Education programs to reach Koolaupoko Watershed residents promoting individual practices that prevent pollution as well as to explain project undertakings.
- Continued funding of the Volunteer Water Quality Monitoring Program.
- Removal of mangrove in Waikalua Loko fishpond and Kawa Stream mouth.
- Stream cleaning.

KBAC SUB-AREA PRIORITIES

- Problem - Eroding stream banks

Priority - landscape and protect stream banks from erosion, and make streams more visible and accessible to the community

- Problem - Mangrove infestations

Priority - remove mangrove to maintain open water areas in wetlands, streams, and fishponds; to maintain channel capacity in streams and drainage ways; and to preserve the appearance of shorelines

- Problem - Routine monitoring by DOH and others does not help much to develop management strategies and measures to improve water quality

Priority - design a custom monitoring/observation program that directs observations at specific watershed management problems and contaminating land uses.

- Problem - Existing watershed management institutions have overlapping jurisdictions, are underfunded, and do not have integrated planning and management procedures to solve watershed water quality problems. Agencies appear resistant to change based on testimony at the last two legislative sessions.

Priority - evaluate management needs and implement appropriate watershed management.

- Problem - Impermeable surface increase

Priority - Require use of permeable paving where feasible, detention ponds, dry wells, new wetlands and other techniques to reduce the discharge of storm water runoff to bays and streams.

During public meetings held in March and April 2002, residents expressed the greatest concern about water quality problems associated with urbanization, including concrete lined streams beds, litter in the streams, and sediment from construction sites and other uses entering the streams and nearshore areas. South Kaneohe residents cited litter as the primary problem, and leptospirosis in streams was a recurring concern (see tables in Appendix V).

The solutions suggested in the KBAC Master Plan (Kailua Bay Advisory Council 2002) include increased penalties and enforcement for littering. Some people noted that slowing the pace of development is a potential remedy for soil runoff. Future plans for water quality improvement included improving stream channels, reducing sediment and nutrient loads, and reducing the impact of introduced species. Two actions were presented for consideration for long-range planning - creation of a permanent entity to engage in watershed issues and concerns, and designation of Koolaupoko as a special area under protective status.

4.0. ROLE OF KANEOHE RESIDENTS

Kaneohe residents are the ultimate force for reducing pollutant loads and improving water quality in Kawa stream and Kaneohe Bay. While the TMDL report did not pinpoint sources of the pollutants that are overloading the stream, it is clear that our everyday behavior creates many water quality problems. We encourage each resident and user of the watershed to accept responsibility for its health and future by refining this everyday behavior, and to work with neighbors to develop community-based solutions to the larger problems in the watershed.

Solutions that are developed from a watershed perspective for integrating water quality management throughout Kawa and adjacent drainage basins will have the greatest impact. This is always challenging given the many residences, businesses, and public facilities that produce polluted groundwater and polluted runoff and the multiple agencies that have management duties, regulatory authority, and planning responsibility for water quality. In such an environment, it may be useful to form a community watershed management advisory body to consolidate representation of community water quality concerns, mobilize community water quality improvement efforts, and to track and participate in related agency activities.

The Kaneohe Neighborhood Board, Kaneohe Bay Regional Council, Kaneohe-Kahaluu Community Vision Team (Stream Advisory Committee), and Kailua Bay Advisory Council are some of the more obvious forums for this kind of effort. The City & County of Honolulu Department of Environmental Services (DES) also has a tremendous role to play, as it operates the storm drain system that conveys most of the runoff from residential and commercial areas to the stream. According to the DES (http://www.cleanwaterhonolulu.com, "NPDES Permit Requirements"), ***only*** the following non-storm waters can be discharged into the municipal separate storm sewer system without an NPDES permit from the State Department of Health ***provided they are not a source of pollutants*** (emphasis added):

- landscape irrigation and irrigation water, excluding runoff from commercial agriculture;
- foundation and footing drain, not including construction related dewatering activities;
- water from crawl space pumps, including discharge from buildings with basements;
- flows from riparian habitats and wetlands;
- air conditioning condensation;
- spring water;
- lawn watering;
- individual car washing;
- dechlorinated swimming pool water;
- street wash water;
- fire hydrant flushing and discharges from potable water sources

Despite these restrictions and supporting City ordinances (Chapter 14-Drainage, Flood, and Pollution Control and Chapter 29 –Streets, Sidewalks, Malls and other Public Places - see http://www.co.honolulu.hi.us/refs/roh/), the difficulty in determining when these discharges ***are*** a source of pollutants makes them hard to enforce. As residents and businesses are reached by water quality education and outreach efforts, they may become more interested in better management of their own discharges and of neighboring activities. This expanded awareness can

lead to improved control of pollutant sources and may facilitate enforcement of existing restrictions on discharges to storm drains.

5.0 GOVERNMENT ROLES AND MECHANISMS

Water Pollution Control Permits

- As of 1994, the Department of Health (DOH) has issued Clean Water Act Section 402 NPDES stormwater discharge permits to the City and County of Honolulu (Department of Environmental Services) and the State of Hawaii Department of Transportation (Highways Division). These permits, which cover medium and large "municipal separate storm sewer systems" generally serving populations of 100,00 or greater (Phase I MS4s), allow these agencies to discharge watershed runoff carried by urban and highway drainage systems into Kawa Stream and other O`ahu water bodies. In conjunction with these permitted discharges, the permittees monitor runoff water quality and conduct programs and activities to improve this quality.

Priority Action: When these permits are renewed in 2004 (and every 5 years thereafter), they will include conditions that support achievement of the load reductions established by the Kawa Stream TMDLs. These permit conditions are enforceable by DOH and EPA. For example, the permit conditions might require that BMPs be applied to reduce nitrogen inputs to the stream in segments where the TMDLs are currently exceeded. In conjunction with EPA and the permittees, EPO is revising these load reductions (Waste Load Allocations) based on closer analysis of impervious cover, runoff and drainage patterns, stormwater pollutant load data, existing management and control measures, and BMP feasibility.

- New regulations require NPDES permit coverage from DOH for discharge of watershed runoff into Kawa Stream and other O`ahu water bodies from small municipal separate storm sewer systems (Phase II MS4s). At present, Phase II MS4s to be regulated include non-agricultural facilities with more than one building on the island of O`ahu that are operated by the federal government, the State of Hawaii Department of Education (schools); the University of Hawaii (campuses); the State of Hawaii Department of Public Safety (prisons): and the State of Hawaii Department of Health (hospitals). Other public and private facilities may also be regulated as Phase II MS4s in the future.

Priority Action: Under their permits, each regulated operator must develop, implement, and enforce a storm water management program designed to reduce the discharge of pollutants from their system to the "maximum extent practicable" (MEP) in order to protect water quality and satisfy the appropriate water quality requirements of the Clean Water Act. The storm water management plan must include six minimum control measures with implementation dates and rationales for each measure, and the permittee must develop measurable goals to gauge permit compliance and program effectiveness for each measure (see Appendix VII). Within the Kawa Stream watershed, regulated operators appear to include three public schools and may also include the Hawaii Veterans Cemetery. These newly regulated entities may have little experience in stormwater management and the their efforts would benefit from technical, financial, and operational assistance in meeting permit requirements.

- New regulations will also require NPDES permit coverage from DOH for any construction activity that will disturb a total ground area of one acre or more.

Priority Action: Under these permits, each regulated operator must submit a construction site best management practices plan. The plan requires eleven minimum elements (Appendix VIII) including an approved County erosion and sediment control plan; a site-specific plan to minimize erosion of soil and discharge of other pollutants into state waters; and descriptions of measures that will minimize the discharge of pollutants via storm water discharges after construction operations have been finished. The new permit requirements are more stringent than those previously required for construction projects disturbing five acres or more of ground area and will have more widespread impacts. Newly regulated entities, particularly smaller construction projects (disturbing one to five acres of ground area) may have little experience in stormwater management and their efforts would benefit from technical, financial, and operational assistance in meeting permit requirements.

- A Water Quality Certification from DOH is required by Section 401 of the Clean Water Act when applying for a federal license or permit to "dredge or fill" a water body. In streams, typical projects involve bridge renovations and other highway improvements; bank hardening to protect riparian property; or more extensive channel modification (enlargement and lining) to achieve conformance with updated County drainage standards. DOH issues a certification when the applicant demonstrates how the activity will be managed to prevent project-related violations of applicable water quality standards. This process allows the DOH to state conditions that are considered necessary or desirable to this end.

Priority Action: Applicants for water quality certification in impaired water bodies where TMDLs are already established (such as Kawa Stream) are asked to demonstrate how a proposed project would contribute to the achievement of the pollutant load reductions suggested in TMDL technical studies. In cases where TMDLs are not yet established, applicants are asked to demonstrate that a proposed project would not cause existing pollutant loads to increase. In both situations, applicants would benefit from technical assistance in selecting more ecologically-friendly stream channel engineering designs and in planning and implementing best management practices to control polluted runoff from construction activities and storm events.

Stream Channel Alteration Permits

- The State of Hawaii Commission on Water Resource Management (COWRM) issues Stream Channel Alteration Permits (SCAP) allowing modifications to channel size, shape, or structure. These projects typically require Clean Water Act Section 401 Water Quality Certification from DOH (see above) and proposed alterations to channels in impaired streams are also reviewed by the TMDL Program (DOH Environmental Planning Office). Recently, a SCAP issued by the COWRM included a condition that "prior to construction activities, the applicant shall submit written documentation from the Department of Health indicating the project's consistency with Section 303(d) and Section 402 of the Federal Clean Water Act" (Commission on Water Resource Management 2002.a.)

- As a result of comments from DOH and the University of Hawaii about a recent SCAP application for flood control work in a branch of Kawa Stream, the COWRM required that "The applicant shall coordinate with the University of Hawaii Environmental Center, the Department of Health (TMDL Program), and the Division of Aquatic Resources to discuss the merits, additional time and costs needed, flood concerns, and feasibility of installing a low flow channel in Kawa Stream" (Commission on Water Resource Management 2002.b.). After one meeting of this discussion group, the applicant determined that "a concrete low flow channel is not likely to be a feasible consideration for the Kawa Ditch channel lining project. Public safety and flood management (meeting drainage standards) outweigh the need for a 'fish-friendly' environment, since the proposed project site is located in an urbanized area with few remaining native species" (see Appendix IX).

Priority Action: The low-flow channel discussion group identified related questions and issues that are a high priority for widespread discussion and action (e.g. channel design parameters, drainage project funding, public education partnerships, and use of stream assessment data – see Appendix IX). Continuing efforts to coordinate DOH and COWRM permitting processes and permit conditions in the interests of water quality protection and improvement are also a high priority for the interagency TMDL working group convened by DOH (Environmental Planning Office).

Nonpoint Source Pollution Control Programs

- The DOH Polluted Runoff Control Program and the State Office of Planning, Coastal Zone Management Program, work together to control or reduce nonpoint source pollution. Their information and education efforts, programs that utilize incentives, and voluntary efforts are not always successful. The federal Coastal Zone Act Reauthorization Amendments, Section 6217, required the State to meet various conditions for approval of its Coastal Nonpoint Pollution Control Program. One of the conditions is that the State must have statewide backup enforceable mechanisms and policies to address nonpoint source pollution. Therefore DOH is drafting administrative rules for Nonpoint Source Pollution Control to strengthen the program established under Hawaii Revised Statutes Chapter 342D (http://www.state.hi.us/doh/eh/cwb/#Polluted Runoff Control Program).

Priority Action: Implementation of the rules as currently drafted would allow DOH to issue warnings, notices of violations, and orders to non-point source pollution "bad actors" and would expand DOH's mandate to help all parties effectively control nonpoint source pollution. Thus building DOH capacity in nonpoint source assessment, investigation, and technical and financial assistance would help the program to achieve greater success. In the process of drafting these rules, DOH also explored several regulatory and voluntary alternatives that can be considered independent of this particular rule making exercise, including:

- greater coordination with other agencies;
- addressing nonpoint source issues during land use planning processes (e.g. zoning decisions, general & community plan updates, and subdivision approvals);
- establishing a dedicated fund to initiate projects, match federal funds, or expand the State's voluntary program;

- offering income or property tax credits for implementation of approved BMP plans; and
- establishing an effluent trading•system that allows operators with less efficient pollution reduction to purchase credits from operators with more cost efficient operation. The seller of credits would then reduce pollution to a greater degree.

- *Hawaii's Coastal Nonpoint Pollution Control Program Management Plan* (Hawaii Coastal Zone Management Program 1996) provides guidelines and 57 specific management measures for reducing nonpoint source pollution from six different areas. Several of the measures for urban areas; roads, highways, and bridges; hydromodifications; and wetlands, riparian areas, and vegetated treatment systems will be useful to implementing Kawa Stream TMDLs. Full text of these measures is available online at:

http://www.state.hi.us/dbedt/czm/6217.html#CNPCPMgmt
http://www.state.hi.us/doh/eh/cwb/prc/pdf-files/imp-plan/app_g.pdf

Priority Action: Kawa could be a high priority site for implementing these management measures. Funding may be available from DOH through the 319(h) program and from the Office of Planning CZM Program.

Wastewater Systems

- Cesspools and Septic Systems

The Department of Health's Hawaii Administrative Rules Chapter 1162 Section 06(l) define the criteria for wastewater treatment in Hawaii. New homes are required to have septic systems (with a 50 ft. setback from streams) or connect to municipal wastewater systems. Homes with existing cesspools are required to upgrade to septic system whenever a bedroom is added to the house and (1) the cesspool is creating a nuisance; (2) records show the cesspool was pumped more than once in the preceding 12 months; or (3) if during initial construction, the cesspool intersected the groundwater.

Our initial review suggests that most of the Kawa Stream watershed is serviced by municipal wastewater systems and there are very few, if any, cesspools or septic systems in use. Existing City & County of Honolulu plans call for improved wastewater treatment and increased treatment capacity in this region, suggesting that all homes, businesses, and facilities with failing cesspools or septic systems should be able to connect to the municipal system. Government agencies can acquire low interest loans from DOH's State Revolving Fund (SRF) to assist with the wastewater treatment improvements, expansion of the collection system, and upgrading cesspools to septic system, and DOH is negotiating with commercial lenders to create a system that would allow private entities to also obtain these loans.

Priority Action: Based on records of sewer infrastructure, sewer fees, and cesspool and septic system registration, DOH will pinpoint existing use of cesspools and septic systems adjacent to the stream. Where chronic failures are suspected, DOH may conduct dye tests and sanitary surveys to determine if wastewater is being discharged to the stream and poses public health risks. DOH can help prevent and correct problems by educating the users about cesspool/septic management measures and wastewater treatment options, or by ordering the property to upgrade the system. Other agencies and NGOs can assist with broader educational efforts and may be able to provide funding for system repair, maintenance, and upgrades.

- Sewer Systems

The City and County of Honolulu's 1999 Long-Range Sewer Rehabilitation Plan is designed to reduce sewage overflows by 78% over the next 20 years by increasing flow capacity in deficient facilities, repairing structural defects in the collection system, and performing physical repairs and source controls in areas with recurrent sewer overflows or maintenance demands (Fukunaga & Associates 1999). During plan development about 15% of the entire collection system was identified as structurally critical. After inspection of these critical sewers, those with severe to moderate structural defects were slated for capital improvements projects, while minor structural defects and non-problem lines are monitored to track their condition over time. Non-critical sewers are addressed by the City's on-going preventive maintenance program. In addition, specific improvements to the collection, treatment, and disposal system in the Kailua-Kaneohe-Kahaluu region are addressed in the City's Wastewater Facilities Plan (Wilson Okamoto & Associates 2000).

Priority Action: DOH will work with the City and County of Honolulu to assess the problems, solutions, and information gaps identified during the rehabilitation and facilities planning processes regarding flow capacity, structural conditions, operational conditions, and preliminary treatment in sewers within the Kawa Stream watershed. This assessment may lead to recommendations for accelerating the completion of scheduled projects and inspecting additional portions of the collection system in order to help reduce pollutant loading from the sewers.

Stream Assessment Conclusions and Use Attainability Analysis

According to the Department of Health's biological assessment of Kawa Stream (Burr 2001) "Restoration of Kawa Stream to enable it to achieve the required water quality standards will require a high level of public and private cooperation and funding." If cooperation and funding cannot reach this level, what do we do? And even if nutrient and sediment loads are significantly reduced, how much of an effect will this have on the overall habitat quality of Kawa Stream, which is currently "Non-supporting' for biotic integrity, causing the biotic integrity of Kawa Stream to be 'Moderately impaired to Impaired?"

The different sections of Kawa Stream assessed all share some characteristics of poor habitat quality such as a low percentage of native plants in the riparian zone, a lack of understory, a high sediment load, and embedded stream bottom. Because Kawa stream has been so altered through channelizing and straightening, and much of the riparian zone is developed as a residential area, low-cost, haphazard, and uncoordinated habitat restoration efforts will probably not achieve significant results (Burr 2001; Oceanit Laboratories, Inc., et al. 2002).

Based on surrounding land use, Kawa Stream is a class 2 inland water body. "The objective of class 2 waters "is to protect their use for recreational purposes, the support and propagation of aquatic life, agricultural and industrial water supplies, shipping, and navigation" (Hawaii Administrative Rules §11-54-03). In its current condition, Kawa Stream supports only aquatic life uses (mainly introduced and invasive species); irrigation (use varies depending upon crop cycles and water availability during low flow conditions), and limited recreational uses (hampered by low flows, nuisance vegetation, and poor water quality).

Although not tested during the TMDL technical study, recreational uses may be threatened by inputs from failing individual wastewater systems and leaking/overflowing sewers, as well as by

the prevalence of leptospirosis in the water column, particularly during and after storm events (leptospirosis is a bacterial disease usually caused by exposure to water contaminated with the urine of infected animals). In 1990, the State Commission on Water Resource Management (COWRM) conducted a statewide appraisal of perennial streams that evaluated their aquatic, riparian, cultural, and recreational resources (HAS 1990). Kawa Stream recreational resources were evaluated as "moderate," other resources were unknown and could not be evaluated. According to HAS recreational stream resources statewide include "stream pools, waterfalls and banks that provide places for people to swim, fish, boat, hike, see wildlife, and enjoy scenic vistas. Recreational opportunities occur in diverse stream settings ranging from concrete urban canals to remote natural streams," but no specific features, much less activities or uses, were identified for Kawa or the other streams assessed.

Priority Action: The Clean Water Act (CWA) provides options for removing designated uses from a particular stream and for adopting sub-categories of a use [see CWA Section 101(a)(2)]. DOH will study the use of these options to alter or remove designated uses for shipping, navigation, aquatic life, and recreation in all or part of Kawa Stream. Since it can be argued that Kawa Stream primarily functions as a storm drain, not as a Hawaiian stream ecosystem, DOH will also study the reclassification of Kawa Stream as a ditch, which would relieve it from compliance with the specific water quality criteria for streams established in Hawaii Administrative Rules §11-54-05.2.

These studies will be initiated by conducting a survey of watershed residents and Kawa Stream water users to obtain more detailed information about current uses of the stream and public attitudes about the relative importance of preserving or abandoning protection for all of its presently designated uses. To demonstrate the process and potential impact of exercising the options provided by the Clean Water Act, DOH will then conduct a Use Attainability Analysis (UAA) for Kawa Stream. This analysis is used to demonstrate that attaining a currently designated use is not feasible for one or more of the following reasons:

(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or
(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

6.0 FUNDING OPPORTUNITIES.

Information about several government and non-government funding sources, including many of those discussed below, is compiled in *Funding Sources for Communities – A Watershed Focus* (Environmental Planning Office 2001). This DOH information packet is available from the Environmental Planning Office. Contact Barbara Matsunaga at 586-4337.

State of Hawaii Department of Health

- Polluted Runoff Control Program grants under Section 319(h) of the Clean Water Act assist state and county agencies and local nonprofit groups with implementing control of nonpoint source pollutants, developing innovative practices for polluted runoff control, or promoting public awareness. TMDL implementation is a priority for funding. All grants require 100% match. Contact: Lawana Collier at 586-4309.

- State Water Pollution Control Revolving Fund programs include low interest (below market rate) loans for state and county agencies to complete various kinds of point and nonpoint pollution control projects. Contact: Dennis Tulang at 586-4294.

State of Hawaii Department of Business, Economic Development, and Tourism

- Coastal Non-Point Implementation Program grants under the Coastal Zone Management Reauthorization Amendments of 1990. Financial assistance to implement management measures for coastal nonpoint pollution control programs. Contact: Susan Miller at 587-2833.

U.S. Department of Agriculture, Natural Resources Conservation Service provides technical and financial assistance through a variety of programs. Contact: Ken Kaneshiro, State Conservationist at 483-8600 x 101.
http://www.hi.nrcs.usda.gov/programs.htm

- Wildlife Habitat Incentives Program (WHIP) offers technical assistance and cost-share payments to private landowners who want to develop and improve wildlife habitat on private lands. Contact Terrell Kelley at 41-2600, ext. 109, or Gwen Gilbert at 541-2600, ext. 122.
- Wetlands Reserve Program (WRP) offers funding to landowners to voluntarily restore and protect wetlands on private property.
- Watershed Surveys and Planning. The purpose of the PL 566 program is to assist Federal, State, and local agencies to protect watersheds from damage caused by erosion, floodwater, and sediment and to conserve and develop water and land resources. Resource concerns addressed by the program include water quality, opportunities for water conservation, wetland and water storage capacity, agricultural drought problems, rural development, municipal and industrial water needs, upstream flood damages, and water needs for fish, wildlife, and forest-based industries. Types of surveys and plans include watershed plans, river basin surveys and studies, flood hazard analyses, and flood plain management assistance. The focus of these plans is to identify solutions that use land treatment and nonstructural measures to solve resource problems.

U.S. Environmental Protection Agency

- Funding Sources for Communities provides a list of ongoing grant programs that are available to a variety of recipients (primarily state and local governments, and nonprofits) within Region 9 (California, Arizona, Hawaii and Nevada). Contacts, phone numbers, and e-mails are listed for each grant program, along with other available information, such as Web sites. http://yosemite.epa.gov/r9/fsfc.nsf/fundingsources?ReadForm

- EPA's Headquarters and other regional and field offices have other grant programs that may occur just once, but these grants are not listed here. For these, check the Catalog of Federal Domestic Assistance at http://www.epa.gpv/ogd/grants/cfda.htm. Also visit EPA's national Grants Web page at http://www.epa.gov/ogd for additional funding information.

- Environmental Education Grants support projects which design, demonstrate, or disseminate environmental education practices, methods or techniques. Local or state education agencies, colleges and universities, nonprofit organizations, state agencies, and non commercial educational broadcasting agencies are eligible to apply. **These grants are currently unavailable and it is uncertain whether the responsibility for Environmental Education will remain at EPA or be shifted over to the National Science Foundation (NSF).** http://www.epa.gov/enviroed/grants.html

Kailua Bay Advisory Council (KBAC)

- KBAC is a private organization funded by a settlement agreement resulting from a lawsuit against City and County of Honolulu. KBAC funds projects to improve the water quality of the Koolaupoko area. Contact: Maile Bay at 225-9210. http://www.kbac-hi.org/

The National Fish and Wildlife Federation

- Coral reef conservation projects address causes of coral reef degradation wherever they occur, including inland areas and coastal watersheds. Projects should build and support public-private partnerships that provide solutions to specific problems through activities such as reducing impacts from pollution and sedimentation and increasing community awareness through education and stewardship activities. Proposals are due January 31, 2003, and another call for proposals is not anticipated before October of 2003. http://www.nfwf.org/programs/coralreef.htm

7.0 WATER QUALITY MONITORING

Although no specific follow-up monitoring is planned at this time, several objectives for future monitoring have been identified. These include:

- Improving our understanding of relative contributions from different nonpoint nutrient load sources. Paved areas, sewer leaks, and cesspools are major concerns, also of interest are fertilizers (especially from large landscaped areas such as park, school, cemetery, and golf course grounds), natural background and forest cover (litterfall and soil nutrient dynamics), animal waste, riparian cover (for example, fruit fall), and household sources.

- Improving our understanding of nutrient loads carried in groundwater.
- Measuring the effectiveness of best management practices (BMPs) at reducing nutrient and sediment loads.
- Assessing water quality improvements as TMDL implementation projects proceed and determining the need for additional controls on nutrients, sediments, and other pollutants.
- Investigating other pollutants and their sources, particularly petroleum products and pathogens.
- Comparing pre-and post-project water quality characteristics in stream segments where flood control and bank hardening projects are constructed, with particular attention to temperature effects.

8.0 TMDL IMPLEMENTATION SCHEDULE

Although we have limited influence over the implementation schedule for many strategies and actions, we can predict when certain implementation opportunities will be triggered by various planning, regulatory, technical assistance, and funding programs:

2003

- Kawa Stream TMDLs have been automatically incorporated into the state's Clean Water Act 208 Water Quality Management Plan and are incorporated into water pollution control permits as appropriate.
- Funding agencies and NGOs have established Kawa Stream TMDL implementation as a priority and begin supporting projects that meet this priority.
- DOH and the City & County of Honolulu assess cesspool and sewer inputs in priority stream segments with high nitrogen loads.
- DOH revises the TMDL Waste Load Allocations to City and State stormwater discharge permittees.
- DOH surveys residents and watershed users about their actual enjoyment and opinion of designated and existing uses in Kawa Stream.
- DOH conducts a demonstration of Use Attainability Analysis for modification of Kawa Stream designated uses and water body classification.
- DOH adopts and enforces administrative rules for polluted runoff control.

2004

- Initial TMDL implementation projects, funded by 319(h) and other sources, are completed.
- DOH reissues City and State stormwater discharge permits with conditions that support achievement of the TMDL Waste Load Allocations to these sources (every 5 years).
- DOH requests proposals for further implementation of the Koolaupoko Watershed Restoration Action Strategy, including Kawa Stream TMDLs.

2005 and beyond

- Ongoing TMDL implementation projects.
- DOH and other stakeholders monitor Kawa Stream to determine if pollutant loads are decreasing and if water quality is improving.

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INTERNET RESOURCES

U.S. Environmental Protection Agency - Polluted Runoff (Nonpoint Source Pollution) Programs
http://www.epa.gov/owow/nps/

State of Hawaii Department of Health - Polluted Runoff Control Program
http://www.state.hi.us/doh/eh/cwb/#Polluted Runoff Control Program

State of Hawaii Department of Business, Economic Development, and Tourism - Coastal Nonpoint Pollution Control Program
http://www.state.hi.us/dbedt/czm/6217.html

City and County of Honolulu - Clean Water Program
http://www.cleanwaterhonolulu.com/

University of Hawaii - Water Quality Extension Program
http://www2.ctahr.hawaii.edu/wq

American Oceans Campaign - Stormwater and Polluted Runoff website
http://www.americanoceans.org/runoff/main.htm

Center for Watershed Protection - Stormwater Manager's Resource Center
http://www.stormwatercenter.net/mwatercenter.net/

Center for Watershed Protection
http://www.cwp.org/

Watershed Science Institute (USDA Natural Resources Conservation Service)
http://www.wcc.nrcs.usda.gov/watershed/

APPENDIX I
KAWA STREAM WATERBODY INFORMATION SHEET

Waterbody Information Sheet: Streams

Stream Name & Location: Kawa Stream, Kaneohe

Inspected By: Gary Wolinsky

Date: 08/15 and 08/27/96

I. RESEARCH
1. Why is this stream being inspected? (choose all that apply) Public Nomination, **Watershed Target**, Other (explain)
2. What land use zoning areas are within this stream's watershed? (choose all that apply) **Urban**, Rural, Agriculture, **Conservation**
3. Is there water quality data available for this stream? **Yes** No -- *Soil, Sediment, and Water Quality Monitoring -- Bay View Golf Course*
3a. Is there evidence of criteria violations? **Yes** No (If "yes," list pollutants.) Three stations on Kawa Stream were monitored during a one year period from 1991 through 1992. Turbidity violations were recorded at the two stations downstream of the Bayview Golf Course. Annual geometric means were 5.27 NTU for KAW3, and 7.06 at KAW1, located at the stream mouth. The wet season turbidity criterion is 5 NTU, the dry criterion 2 NTU. Values for nitrate + nitrite nitrogen were excessive. Annual geometric means for the three stations KAW2, KAW3, and KAW1, were 1092 ug/L, 1044 ug/L, and 893 ug/L, respectively. This compares to a criterion of 70 ug/L. Total nitrogen was similarly elevated. Annual geometric means for KAW2, KAW3, and KAW1, were 1414 ug/L, 1385 ug/L, and 1333 ug/L, respectively. This compares to a wet weather criterion of 250 ug/L. The two stations downstream of the golf course recorded violations for total phosphorus as well. Annual geometric means for KAW3 and KAW1 were 64 ug/L and 68 ug/l , respectively. The wet season total phosphorus criterion is 50 ug/L.
4. Has this stream ever been subject to fish consumption advisories, or health warnings (excluding leptospiroses)? Yes **No** (If "yes," describe the action and attach documentation to this sheet.)
5. Has this stream ever suffered any fish kills? Yes **No** (If "yes," list their date and magnitude, and attach documentation to this sheet.)
II. FIELD ASSESSMENT

1. If there are criteria violations for this stream, are the sources of these pollutants readily apparent? Yes **No** Discuss.
2. Is this stream being impaired by point source discharges? Yes **No** (If "yes," discuss.)
3. Are any of the following activities occurring in the watershed: agriculture, commercial enterprise, construction, or **residential development?**(choose all that apply)
4. If so, are any of these activities occurring on such a scale as to be significant pollutant sources for this waterbody? Yes **No** (If "yes," discuss, listing pollutants and transport mechanisms.)
5. Is there evidence of nutrient enrichment, including algal blooms or excessive amounts of nuisance vegetation? **Yes** No **Severe algal bloom** -- source not clear, turf management at Hawaiian Memorial Park Cemetery is a potential upstream source
6. Is there a significant amount of debris or litter? Yes **No**
7. Has the stream channel been channelized with concrete or substantially modified or straightened? **Yes** No
8. Has the riparian area been cleared of vegetation? **Yes** No
9. Is there evidence of significant erosion in the stream channel? **Yes** No deep incised and eroded above culverted and channelized reach behind Parkside Recreation Center at the Mokulele/Kumakua crossing
10.Evaluate the visual water quality. Severe algal growth clogging stream channel
11. How is this water used, and by whom? Drainage

12. Comments

Check out potential sources of loading -- Hawaiian Memorial Park Cemetery

Long-time local resident said that this area was historically dairy land -- long time ago

Access to stream at Mokulele Drive (near Mikihilina) follow easement to confluence

Also access at Namoku

Access to stream behind Parkside Rec Center at Mokulele and Kumakua, also at Hawaiian Memorial Park Cemetery, Veteran's Memorial Section below maintenance yard

Water quality data correspond to algal growth.

13. Is this stream of high enough quality that it should not be considered impaired? Discuss.

No. This stream is badly choked with algae in the upper reaches below the Hawaiian Memorial Park Cemetery, Veteran's Memorial Section. Lower reaches downstream of the Bayview Golf Course and discharging to Waikalua Fish Pond are extremely turbid -- it's not clear whether this is a short term effect of the earthwork at Bay View Golf Course. Unchannelized reach below the cemetery is deeply incised and eroded.

APPENDIX II
KAWA STREAM TMDL EXECUTIVE SUMMARY
(Oceanit Laboratories, Inc., et al. 2002)

This document proposes to establish "Order of Magnitude" Total Maximum Daily Loads (TMDLs) for total suspended solids (TSS), total nitrogen, and total phosphorus in Kawa Stream. Kawa Stream drains directly into the southern portion of Kaneohe Bay, which is bounded by the only barrier reef in the United States. The stream is included on the State's Clean Water Act Section 303(d) list of impaired waters that do not meet State Water Quality Standards and is considered to be impaired by sediments, turbidity, and the nutrients nitrogen and phosphorus. These pollutants may augment unwanted algae growth in the stream and impact coral reef resources in the receiving waters of Kaneohe Bay. The water quality goal of these TMDLs is to control sources of TSS and nutrients to improve the water quality of the system, so that the designated uses for Kawa Stream will be maintained.

We conducted water quality and flow measurements in the stream to determine existing levels of water pollution. Measurements were made during periods of dry and rainy weather. Rainfall measurements and streamflow data were used to estimate runoff from multiple locations within the watershed. The watershed was divided into 8 sub-watershed basins and the land uses within each basin were determined from a Geographic Information System (GIS) database with visual groundtruthing.

Two methods are used to determine pollutant loads. One method combines a hydraulic model with pollutant concentration profiles to calculate load based upon total rainfall during an event. The other method uses a simpler matrix multiplication and mass balance approach to estimate pollutant loads. Both methods yield similar results.

Load allocations (LA) for TSS, total nitrogen, and total phosphorus entering Kawa Stream are established for both Wet and Dry (Winter and Summer) base flows and for annual storm flow conditions (Tables 5.4, 5.5 and 5.6). These load allocations represent pollution reduction guidelines associated with different land uses in the watershed, taking into account several factors including water quality standards, seasonal variations, natural loading, an environmentally conservative margin of safety (MOS), and future growth.

During base flow conditions existing loads of total phosphorus (TP) and total suspended solids (TSS) produce water quality that is presently within State Standards, but turbidity levels exceed State Standards. Turbidity is also a concern under storm conditions when TP and TSS also exceed State Standards in some stream branches. Because both turbidity and TP are correlated with TSS during storm flows, we propose implementing a TMDL for TSS during storm runoff conditions as a potential control mechanism for both turbidity and TP. Existing loads of TN produce water quality that does not meet State Standards during base flows and storm conditions, and TMDLs are established for this nutrient under all flow conditions. The major source of the nitrogen appears to be groundwater.

The desired base flow, non-point source TMDLs assume no point sources and are computed by multiplying observed rate of base streamflow by the State Standard concentrations. This gives the maximum amount of pollutants that should be allowed in the stream if the stream is expected to support its designated uses (Table 4.12). The difference between the pollutant load the stream

is presently carrying and the desired base flow, non-point source TMDL becomes the load reduction goal for a particular pollutant (Table 4.13).

The dry season baseflow TMDL target for nitrogen is 56 kg per 6 months, or 0.3 kg/day. Reaching this goal will require a reduction in nitrogen input of 1.25 kg/day. The wet season base flow TMDL target for nitrogen is 250 kg per 6 months or 0.62 kg/day. Reaching this goal will require a decrease in nitrogen input of about 1.7 kg per day. No base flow TMDLs are required for TP or TSS.

Storm runoff TMDLs are required for TN, TP, and TSS. The storm runoff goal for nitrogen of 0.67 kg/day will require a total decrease in nitrogen input of about 1.17 kg/day. Achieving the phosphorus daily storm load of 0.24 kg/day will require a phosphorous load reduction of 0.22 kg/day. Meeting the TSS daily storm load requirement of 48 kg/day will require a sediment load reduction of 17 kg/day.

We also conducted a biological assessment of Kawa Stream that produced baseline information about the stream's habitat characteristics and biotic integrity. The assessment provides an additional framework for tracking changes in stream conditions over time and for comparing conditions in Kawa Stream with conditions in high quality reference streams. Although the resulting Habitat and Biotic Integrity TMDLs are not a subject for EPA approval, they can help guide TMDL implementation towards areas where pollutant load reduction measures may best contribute to restoring stream habitat and biota.

TMDL implementation suggestions were solicited from community members and are summarized in the final section of this document. The DOH Environmental Planning Office is continuing to stimulate public participation in order to produce a Kawa Stream TMDL Implementation Plan developed with input from a range of concerned residents and responsible government agencies. The Plan is intended to guide the community and agencies in their work to improve Kawa stream and to assist them in identifying and obtaining funds to support projects that reduce stream pollution and improve stream water quality.

Figure 3. Kawa Stream TMDL Public Information Meeting, October 2001

APPENDIX III
Results of Brainstorming Exercise for Kawa Stream TMDL Implementation

Kawa Stream TMDL Public Information Meeting
10/30/2001
(Oceanit Laboratories, Inc., et al. 2002.)

Idea	Votes
Educate people about alternative landscaping and construction methods. Develop residential and commercial BMPs	7
Explore alternative bank stabilization measures	5
Castle High School/Community – Pollution prevention project: Erosion, nutrients (Agriculture curriculum)	5
Fish-friendly low flow channels	4
Riparian planting demonstration/Plant sources	4
Rip out all the concrete	3
City and County of Honolulu/Castle High School - Bank stabilization	3
Reduce slope of banks	3
Alternative ways to control overgrowth of vegetation in channel/on banks	3
Public awareness campaign at Windward City Shopping Center	3
Tell the story of the stream	2
Establish erosion control and siltation basins along periphery	2
Eradicate armored catfish and other alien fishes	2
Treat street runoff	2
Appreciation through education, access, and improvement	1
Recycling of nutrient-laden water	1
Identify/advertise public access locations	0
Pathway/Greenway through stream	0
Investigate gasoline sources and reduce	0
More native species	0
Educate about new introductions of alien species	0
Reintroduce native species	0
TOTAL VOTES AVAILABLE (4 votes per person, 18 signed in to meeting)	**72**
TOTAL VOTES CAST	**50**

Ideas listed first by votes cast, then by order of submission. Participants also noted the existence of a related City and County of Honolulu Vision project in process for Kaneohe (contact Steve Kubota) and an overriding engineering and government service mandate to maintain public health and safety.

APPENDIX IV
Key Participants in TMDL Implementation

Participant	Project/Concern	Contact Person	Phone
RESIDENTS	Parkway Community Association		235-6734
BUSINESSES			
Kaneohe Business Group		Herb Lee	262-3261
BayView GolfPark	Erosion control, stream clearing, stream water use	Tom Nishiyama	247-0451
Hawaiian Memorial Park Cemetery	Landscape maintenance	Paul Hoffman	233-4400
Windward City Shopping Center	Property management	Ward Young	236-2527
ELECTED OFFICIALS	**ELECTION RESULTS PENDING**		
Governor's Office			586-0034
State Senate District 24		Senate Clerk	586-6720
State House Districts 48 and 49		House Clerk	586-6400
City Council District 3		Council Clerk	547-7000
Kaneohe Neighborhood Board #30		Neighborhood Commission	527-5749
GOVERNMENTAL ORGANIZATIONS			
Kaneohe Bay Regional Council			587-0405
Kaneohe-Kahaluu Community Vision Team Stream Advisory Committee	Stream Restoration and Maintenance	Rodney Funaksohi	946-2277
PUBLIC FACILITIES			
State of Hawaii Department of Education			
Castle High School	Science and Agricultural Education	Sheila Cyboron Dale Fukada	233-5600
Kaneohe Elementary School			233-5633
Puohala Elementary School			233-5660
State of Hawaii Department of Defense	Hawaii Veterans Cemetery	Miles Okamura	233-3630
State of Hawaii Department of Transportation-			
Highways Division	Stormwater management	Dean Yanagisawa	831-6793
City & County of Honolulu			
Department of Parks and Recreation, District 4	Bayview Park	Wilfred Ho	233-7303

Department of Design and Construction	Bayview Park	Steve Tong	523-4799
Department of Design and Construction	Stream channel alterations	Dennis Toyama	523-4563
Department of Environmental Services	Stormwater management	Gerald Takayesu	527-6104
Department of Environmental Services	Sewer trouble/spills Treatment plants/pump stations Cesspool pumping Sewer connection		523-4423 847-8307 523-4421 523-4429
Department of Facilities Maintenance	Storm drains and drainage channels	Larry Leopardi	692-5051
Non-Governmental Organization (NGOs)			
Koolau News	Public information	Shannon Wood	263-6001
Kaneohe Community Family Center	Community services		235-7747
Kaneohe Community and Senior Center	Community services		233-7318
Waikalua Loko Fishpond Preservation Society	Fishpond	Matt Lyum	282-5496
Ahupua`a Action Alliance	Watershed management	Steve Kubota	235-1279
REGULATORS			
State of Hawaii Department of Land and Natural Resources			
Commission on Water Resource Management	Resource protection and enhancement	Linnell Nishioka	587-0214
Division of Aquatic Resources	Fisheries, resource protection	William Devick	587-0100
State of Hawaii Department of Health			
Clean Water Branch	Water Pollution Control permits	Alec Wong	586-4309
	Enforcement	Mike Tsuji	586-4309
Wastewater Branch	Wastewater Systems	Dennis Tulang	586-4294
TECHNICAL ASSISTANCE			
State of Hawaii Department of Health			
Clean Water Branch	Polluted Runoff Control Program	Lawana Collier	586-4309
Environmental Planning Office	Total Maximum Daily Load Program	David Penn	586-4370
FUNDING ASSISTANCE			
U.S. Environmental Protection Agency	Pacific Islands Contact Office	Wendy Wiltse	541-2752
State of Hawaii Department of Health	Polluter Runoff Control Program	Lawana Collier	586-4309
State of Hawaii Department of Business, Economic Development, and Tourism	Office of Planning Coastal Zone Management Programs	Susan Miller	587-2883
Kailua Bay Advisory Council	Watershed Restoration	Maile Bay	225-9210

APPENDIX V
KAILUA BAY ADVISORY COUNCIL COMMUNITY FEEDBACK AND PRIORITIES

Kailua Bay Advisory Council Community Feedback Record for Kawa Stream
Compiled from Community Feedback Record for Streams in S. Kaneohe Bay Watershed *In:* Kailua Bay Advisory Council. nd. KBAC Community Feedback Record - Kaneohe.
http://www.kbac-hi.org/Reports/Issues/iss_kaneohe.html

Ref.	Respondent	Location	Problem	Solution
25	Female	Streams feeding Kaneohe Bay	"pollution"	Don't know
241	Student, family, or neighbor	Kawa stream	leptospirosis	don't pollute
242	Student, family, or neighbor	stream back of Luana Pl.	rubbish	clean it up
243	Student, family, or neighbor	stream back of Luana Pl.	rubbish	clean it up
244	Jessica Hauk, 239-5566	Kawa stream	rubbish	have a clean up day
245	Mr. Albergrass	Kawa stream	Channelization, intro of alien and pest species, non-point	golf course, which has altered stream, should pay for clean up
246	Student, family, or neighbor	Kawa stream	greenwater, dumping	strict penalties
247	Mark Kane 247-5945	"Waikalua Stream"	Sewage dumping	increase capacity to prevent runoff
248	Student, family, or neighbor	"Lily pond (Waikalualoko Pond/Kawa Stream)"	leptospirosis	
249	Student, family, or neighbor	"Castle river"	litter	stiffen punishment

Kailua Bay Advisory Council Community Priorities for South Kaneohe Bay

Table 4A. Actions to Improve Water Quality for Koolaupoko *In:* Kailua Bay Advisory Council.2002. Interim Master Plan for Koolau Poko Watersheds.
http://www.kbac-hi.org/masterplan.htm

South Kaneohe Bay								
a	**Problem**	**b**	**Comments**	**Proposed action**	**c**	**Actors**	**Cost Est.^**	**Start Date**
A	**Urban runoff:** excess chemicals, nutrients, and sediment, especially from roads and streets and impacting Kane'ohe Stream Flood Control Project and plumes at He'eia Stream.		Cesspools, leaking sewage lines, golf course fertilizers all contribute. Dredging needed periodically for Kane'ohe Stream flood control.	Install storm drain filters.	1	Env Svc, DOH, COE, NGOs	$$	*2002*
				Educate residents and construction companies about erosion prevention techniques.	1		$	*2003*
				Dredge.	2		$$$$$	*2004*
				Monitor and enforce grading/construction permit conditions.	1		$$/ year	*on going*
				Train community how to report and enforce violations.	1		$	*2002*
B	**Alien species** – mangrove around shoreline and increased bubble algae		Bubble algae can be an indicator of poor water quality.	Identify and prioritize problem areas of mangrove infestation.	1	NGOs DLNR Residents	$	*2002*
				Properly remove.	1		$$$	*2003*

Table notes: a = priority of the action(s) (i.e., A = highest, B = 2nd highest)
b = magnitude of a problem or concern (1 = greatest, 3 = least)
c = technical feasibility to resolve the problem (1 = most likely, 3 = least likely)
^ **Estimated costs:** $ = 0-25K; $$ = 25K-100K; $$$ = 100K-250K; $$$$ = 250K-1M; $$$$$ = 1M greater [K= $1,000 and M = $1 million]

APPENDIX VI
LETTER FROM WAIKALAUA LOKO FISHPOND PRESERVATION SOCIETY
Waikalua Loko Fishpond Preservation Society

September 12, 2002

David Penn, Ph.D.
Hawaii State Department of Health
Environmental Planning Office
919 Ala Moana Blvd., Room 312
Honolulu, HI 96814

Re: Kawa Stream Study

Dear Dr. Penn:

The Waikalua Loko Fishpond Preservation Society (WLFPS) was founded in June 1995 to manage and implement a preservation plan for the Waikalua Loko fishpond. The Waikalua Loko fishpond is located on the southern shores of Kane'ohe Bay, adjacent to Kawa Stream on its northeastern side. Current historical information indicates that the pond has been in existence for at least 150 years. The current gates or makahas were last modified in 1930. The pond has a surface area of approximately 11+ acres.

The WLFPS supports the State of Hawaii Department of Health's efforts to study and improve Kawa stream and all Hawaiian waterways. Kawa is of significant cultural and scientific interest to us since it originally channeled partially into the Waikalua Loko fishpond.

The Waikalua Fishpond has had thousands of visitors to the pond. These visitors include school groups of all ages. The pond is also the test site for developing Hawaii State DOE approved curriculum through a grant awarded to the Pacific American Foundation. The WLFPS also schedules workdays throughout the year to clean the beach and pond of marine debris, and to control non-native invasive plants such as mangroves. We have plans for reforestation with native plants, restoration of the fishpond walls, and many other culturally and environmentally conscientious activities.

The Society is in favor of two actions as a result of the DOH study:

1. Rebuilding an auwai from Kawa Stream into Waikalua Loko.

   This auwai (channel) must be controlled by the Society by a gated weir system. As the original Hawaiian caretakers managed the water flow, as well as modern aquaculturists do today, the WLFPS must manage the input of water from Kawa for the health of the Waikalua Loko pond.

2. Revegetation of the stream banks by native plants.

   This must be done in a manner that would not further degrade or erode the stream and river banks. The species of plant should be culturally and botanically correct for the area, and not be invasive to the stream or fishpond.

If you have any questions regarding our comments, please feel free to call me at 282-5496.

Mahalo,

Matt Lyum
President
Waikalua Loko Fishpond Preservation Society

APPENDIX VII
Minimum Control Measures for NPDES Phase II MS4 Permits
(Clean Water Branch 2002.b.)

(1) Public Education and Outreach

Develop and implement a public education program to distribute educational materials to users of the permittee's small municipal separate storm sewer system or equivalent outreach activities emphasizing the following:

(A) Impacts of storm water discharges on water bodies,

(B) Hazards associated with illicit discharges, and

(C) Measures that users of the permittee's small municipal separate storm sewer system can take to reduce pollutants in storm water runoff, including, but not limited to, minimizing fertilizer application and practicing proper storage and disposal of chemicals and wastes;

(2) Public Involvement/Participation

Include users of the permittee's small municipal separate storm sewer system in developing, implementing, and reviewing the storm water management plan;

(3) Illicit Discharge Detection and Elimination

Develop, implement, and enforce a program to detect and eliminate illicit discharges that, at a minimum, includes the following:

(A) Establishment of rules, ordinances, or other regulatory mechanism, including enforcement procedures and actions, that prohibit non-storm water discharges, except those listed in section 1 that do not cause or contribute to any violations of water quality standards, into the permittee's small municipal separate storm sewer system,

(B) Procedures to detect and eliminate illicit discharges (as defined in 40 CFR Section 122.26(b)(2)), and

(C) Compilation of a list of non-storm water discharges or flows that are considered to be significant contributors of pollutants to the system and measures to be taken to prevent these discharges into the permittee's small municipal separate storm sewer system, or reduce the amount of pollutants in these discharges;

(4) Construction Site Runoff Control

Develop, implement, and enforce a program to reduce pollutants in storm water runoff entering the permittee's small municipal separate storm sewer system from construction activities disturbing one acre or more, including construction activities less than one acre that are part of a larger common plan of development or sale that would disturb one acre or more, that, at a minimum, includes the following:

(A) Establishment of rules, ordinances, or other regulatory mechanism, including enforcement procedures and actions, that require erosion and sediment controls,

(B) Requirements for construction site operators to implement appropriate erosion and sediment control best management practices,

(C) Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality,
(D) Procedures for site plan review which incorporate consideration of potential water quality impacts,
(E) Procedures for receipt and consideration of information submitted by the public, and
(F) Procedures for site inspection and enforcement of control measures;

(5) Post-Construction Storm Water Management in New Development and Redevelopment

Develop, implement, and enforce a program to reduce pollutants in storm water runoff entering the permittee's small municipal separate storm sewer system from new development and redevelopment projects that disturb greater than or equal to one acre, including construction sites less than one acre that are part of a larger common plan of development or sale that would disturb one acre or more, that, at a minimum, includes the following:

(A) Establishment of rules, ordinances, or other regulatory mechanism, including enforcement procedures and actions, that address post-construction runoff from new development and redevelopment projects,
(B) Structural and/or non-structural best management practices to minimize water quality impacts and attempt to maintain pre-development runoff conditions, and
(C) Procedures for long-term operation and maintenance of best management practices.

(6) Pollution Prevention/Good Housekeeping

Develop, implement, and enforce an operation and maintenance program to prevent and reduce storm water pollution from activities, including, but not limited to, park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and storm water system maintenance that, at a minimum, includes the following:

(A) Good housekeeping and other control measures, and
(B) Employee and contractor training on good housekeeping practices to ensure that good housekeeping measures and best management practices are properly implemented.

APPENDIX VIII
Information to be Included in Notice of Intent to be Covered by NPDES General Permits for Construction Activity

(Clean Water Branch 2002.a.)

Construction site best management practices plan containing, at a minimum, the following information:

(A) Site characterization report which describes at a minimum, the history of the land use at the proposed construction site, the potential pollution source(s) in the history and from the operation of the proposed construction activity, the potential pollutant(s) present at the existing site, and any proposed corrective measures;

(B) Description of the nature of the construction activity, including a proposed timetable for major activities with the date when the contractor will begin the site disturbance;

(C) Total area of the site and the area of the site that is expected to be disturbed, including clearing, grading, excavation, staging or any combination of the above;

(D) Quantity of storm water runoff, with supporting calculations;

(E) Description of the nature of the fill material to be used and existing data describing the soil or the quality of any discharge from the site;

(F) Site map showing, at a minimum: approximate slopes anticipated after major grading activities; areas of soil disturbance; drainage patterns; areas used for the storage of soils or wastes; the location where stabilization practices are expected to occur; the location of all structural controls; the areas where vegetative practices are to be implemented; the location of impervious structures (including buildings, roads, parking lots, etc.) after construction is completed; wetlands and other state water(s); and the boundaries of 100-year flood plains, if determined. A site-specific site map shall be submitted at least thirty days before the start of construction activities;

(G) Descriptions of construction management techniques, vegetation controls, and structural controls. At a minimum, the requirement listed in section 11 of this general permit must be addressed;

(H) Approved County erosion and sediment control plan as appropriate for the activity and a schedule for implementing each control shall be submitted to the director with the notice of intent or thirty days before the start of construction activities;

(I) Site-specific plan to minimize erosion of soil and discharge of other pollutants into state waters, including removal procedures for the construction site best management practices, shall be submitted to the director with the notice of intent or thirty days before the start of construction activities. The plan must be signed in accordance with section 11-55-34.08(e) and be kept at the construction site;

(J) Descriptions of measures that will minimize the discharge of pollutants via storm water discharges after construction operations have been finished. Examples include: open, vegetated swales and natural depressions; structures for storm water retention, detention, or recycle; velocity dissipation devices to be placed at the outfalls of detention structures or along with the length of outfall channels; and other appropriate measures; and

(K) The identification of all non-storm water sources that connect to the storm water drainage system and non-storm water pollution prevention measures that will be implemented during construction.

APPENDIX IX
Summary of Kawa Stream Improvements Stream Channel Alteration Permit (SCAP) Coordination Meeting

(Department of Design and Construction 2002)

ATTENDEES

City and County of Honolulu
Dennis Toyama, Dept. of Design and Construction, Civil Design and Engineering
Tyler Sugihara, Dept. of Design and Construction, Civil Design and Engineering
Larry Leopardi, Dept. of Facilities Maintenance, Division of Road Maintenance
Dept. of Health (DOH), Environmental Planning Office
David Penn
UH Environmental Center
John Harrison
Dept. of Land and Natural Resources, Aquatic Resources Division
Annette Tagawa
Gray, Hong, Bills, Nojima & Associates
Sheryl Nojima

MEETING DATE/LOCATION

February 25, 2002, 1:30 P.M.
15th Floor Conference Room, Honolulu Municipal Building

SUMMARY

1. Review of Project Background and Status

The proposed project is located in a residential subdivision at the upstream end of the East Kawa Tributary. This section of the tributary was originally realigned in the early 1960s when the subdivision was constructed. The channel lining project was initiated in 1994 by the City and County of Honolulu. Various permits and approvals were secured and construction plans were approved in 1995. The project went out to bid, however, the City was unable to fund the construction. Subsequently permits expired in 1997.

In 1998, Kawa Stream was listed as a Water Quality Limited Segment (WQLS) under Section 303(d) of the Clean Water Act (CWA). As mandated by the CWA, the Hawaii Department of Health conducted a study to determine total maximum daily loads (TMDL) for nutrients and sediments in the entire Kawa Stream. The TMDLs are currently under review for approval by the U.S. Environmental Protection Agency (EPA).

As bank erosion and odors continue to be a major concern of nearby residents, the City resurrected the ditch lining project in 2001. From an engineering standpoint, the project is also warranted due to the fact that the capacity of Kawa Ditch does not meet current City storm drainage standards (2000).

The proposed re-design is very similar to the approved 1995 design in terms of channel length, width, and cross section. The channel bottom has been revised to slope towards the middle at a slope of two percent. This would contain the low flows towards the middle of the channel and provide an access for maintenance crews to walk along the two sides. The two percent slope is equivalent to the slope on a typical road section. The proposed concrete ditch has been modeled at its design capacity using HEC-RAS 3.0 resulting in the following velocities: Inlet - 10.5 feet per second (fps), Mid - 19 to 25 fps, and Outlet transition - 5 to 8 fps. The cost

estimate has been projected at $1.4M and funding is being sought for the City's FY 2003 CIP budget.

2. Discussion on Low Flow Channel

The purpose of the coordination meeting was to satisfy the conditional requirement on project's Stream Channel Alteration Permit (SCAP OA-328):

> "coordinate with University of Hawaii Environmental Center, the Department of Health (TMDL Program), and the Division of Aquatic Resources to discuss merits, additional time and costs needed, flood concerns, and feasibility of installing a low flow channel in Kawa Stream."

Individuals representing the above agencies provided the following comments:

David Penn, Department of Health, Environmental Planning Office

The DOH's concern is not limited to the ditch itself, but the entire Kawa Stream. The recent TMDL study has examined sediment concentrations at various flow conditions and at different segments of Kawa Stream. In light of the proposed TMDLs for Kawa Stream, DOH is interested in the design of the ditch and how it affects water quality especially downstream of the project site.

DOH will also be administering CWA Section 319 grants which provide funding for work in WQLS areas once TMDLs have been established and approved by EPA. In addition to Kawa Stream, other WQLS areas in Hawaii include Ala Wai Canal, Waimanalo Stream, Kaneohe Stream, Waikele Stream, Pearl Harbor, and Honolulu Harbor. A low flow channel (LFC) may have also been constructed at Iao Stream.

John Harrison, UH Environmental Center

Research has indicated that the integrity of water quality can be preserved by incorporating a LFC. Traditional concrete channels have often resulted in elevated water temperatures and considerable pH change which are not conducive to aquatic life. The LFC will tend to minimize these effects on water quality because of a more concentrated area (greater normal depth and smaller surface area), for example, 2' wide LFC versus a 30' wide ditch.

Most stream channelization projects today occur in already urbanized and developed areas where there is essentially no remaining riparian vegetation. Thus, decision-makers must attempt to balance the engineering/water resources management requirements with the preservation of ecosystem(s). The Kawa Ditch project is probably not a good choice for a LFC under the present circumstances.

Annette Tagawa, Department of Land and Natural Resources, Aquatic Resources Division

Kawa Stream is a very altered stream full of exotic species. There are few remaining native species. The proposed project would not be of significant concern to their division because it is located in an urbanized area. Public safety is of much higher priority in this case.

In general, a smooth concrete channel does not provide a suitable physical and chemical environment for native inhabitants. For example, they prefer to live behind rocks. In addition, concrete will tend to heat up the water, and there is potential leaching of chemicals from the concrete over time. Stream velocity is not the primary issue here.

Larry Leopardi, Department of Facilities Maintenance, Division of Road Maintenance

The LFC must be maintainable by mechanical means. The minimum channel width would be roughly 5 feet to allow for dredging equipment. A preventive approach would be to minimize

or stop dumping into drainage ditches altogether The public needs to know that it is easier and less costly for the City to remove trash from the sidewalk rather than drainage ditches and streams. The Division of Road Maintenance has been involved in public outreach at various levels.

Sheryl Nojima, Gray, Hong, Bills, Nojima & Associates

Additional cost for the LFC based on a smaller 2' X 2' cross section would be roughly $150 to $300 per linear foot of channel length. Based on a 900 (+/-) channel, this could raise the construction cost by as much as $270,000. A larger channel width would obviously increase the cost.

3. Summary of Discussion and Recommendations

Based on the discussion above, a concrete low flow channel is not likely to be a feasible consideration for the Kawa Ditch channel lining project. Public safety and flood management (meeting drainage standards) outweigh the need for a 'fish-friendly' environment, since the proposed project site is located in an urbanized area with few remaining native species. While a concrete low flow channel may concentrate the base flow in a smaller cross section, there is still the potential concern for water chemistry and a physical environment that is not entirely conducive to aquatic life in the stream.

Other important questions and issues have been raised for further discussion:

1. What would be design parameters for a low flow channel in areas where there are more native species?

2. How can the Department of Design and Construction become more involved with the Department of Health in terms of Section 319 grants for drainage projects?

3. More partnerships are needed to raise awareness and educate the public in topics such as stream dumping.

4. Hawaii stream assessment data over the past twenty years may be valuable in prioritizing resources for water quality and drainage improvement projects.

5. Develop engineering toolkits that: (a) provide alternative designs and construction information for bank stabilization and stormwater conveyance projects and (b) facilitate analysis of potential downstream water quality effects for all drainage improvement projects.